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## THE SANITARY REGULATION OF THE SCHOOL-ROOM WITH REFERENCE TO VISION\*

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If the ocular apparatus of the average child were by nature adapted to the amount and kind of eye-work that he is ordinarily called upon to do, it would not be so necessary for us, as physicians, to consider, as we often do, the details of school hygiene. In spite of the fact that the eyes are the organs, above all others, that are called upon to labor excessively in the effort to obtain an education, they would cause us little or no anxiety if there were any provision in them for an unusual amount of accommodative effort—for excessive focusing for near work in particular. In the great majority of cases the opposite is true. We are all of us born farsighted, i. e., with the vision and visual apparatus of our savage ancestors, and with these eyes we deliberately proceed to the school-work that civilization demands, which, for its easy accomplishment, necessitates quite a different type of eye, viz., shortsighted or myopic globe with an oculo-muscular system in correspondence with it. Happily, quite a few of us run the gauntlet of these dangers to our nervous and digestive apparatus and to our sense organs with little or no damage, but some of us experience ills from which we recover either partially or not at all.

In estimating the value of sanitary precautions in the regulations of the average schoolroom it must be remembered that a respectable percentage of children begin their school life with congenitally defective eyes. Quite apart from the treatment of this aspect of school life, which I do not propose to discuss here, it follows that any advantage accruing to the merely farsighted

\* Read at the Annual Meeting of the American Academy of Medicine, Boston, June 2, 1906.

pupil in easing the burden of his eye-strain is of manifold greater assistance to the boy or girl who assumes the tasks of study with astigmatic, diseased, or organically defective eyeballs.

Even if the eyes of every school child were, as they ought to be, carefully examined every year for the purpose of detecting and treating all errors of refraction, all defects in accommodation, and all anomalies of oculo-muscular balance, there would still remain many who, from incurable or only partially curable eye defects, need every possible aid to comfortable vision that can be afforded them.

It must also be borne in mind that there are numerous diseases of the other sense organs as well as of the system generally that, neglected or incapable of cure, reduce the effectiveness of the visual function. Even where the eyes are comparatively free of congenital defects or active disease, ineffective digestion due to poor food or other cause, acquired or hereditary diseases of many sorts, obstructed breathing, imperfect mental development, etc., not uncommonly serve to weaken one or more parts of the visual mechanism, and the child so affected is unable to continue his studies.

It is, consequently, not alone for the sake of preserving the eyesight of the ordinary healthy pupil that hygienic precautions are of supreme value in the schoolroom, but that we may not add to other considerable burdens the serious drawback of eye-strain.

In considering a few of these questions let me say that although the discussion of them has been going on since the early days of public education, they still present ever new, because ever changing, aspects, and this fact is another justification I offer for presenting them to you once more.

*The illumination of the schoolroom.*—This is the oldest of the questions relating to the hygiene of school vision. It seems strange that, although one of the simplest and most easily applied of the rules of school sanitation has been known for many years, it is so often overlooked. I refer to the *dictum* of Risley, that at any hour of the day in any season of the year it should be possible to read the finest (diamond) print in any part of the schoolroom. If this can be done the illumination is *sufficient*. It may, of

course, be *excessive* (too strong light may be admitted to the school, or the artificial illumination may be unduly concentrated) or even too variable, but these are not the usual faults. Speaking for Chicago, I believe that, considering the rapid growth of the city and the constantly increasing demands upon us for school space, our school board has done wonders, yet there are many schoolrooms in which pupils and teachers strain their eyes, worry their nervous systems, upset their digestive apparatus and contribute to other forms of mental and physical distress by attempting to see by insufficient or improper illumination.

I do not, of course, say that in a crowded city with its atmosphere befouled with smoke it is always possible to secure, especially during the winter, an ideal illumination, but the continual agitation of this important matter has enabled us to obtain better-built and better-lighted schoolhouses. Largely due to this cause is the decent light in our public schools as compared with the generally wretched illumination of our federal, state, and municipal buildings. Everybody, even the proverbial schoolboy, knows that in the construction of the schoolhouse the distance that separates it from surrounding buildings should be at least twice their height and that the window space of the exterior walls having a northern or western exposure should be quite one-fourth the floor space, although it may be only one-fifth of the floor area when the schoolroom has an unobstructed southern or eastern exposure. Of course, I need not say that the application of this rule must be somewhat modified, as in the case of all rules, by individual instances. In small rooms with a generally clear atmosphere, or where the school buildings can be elevated well above their surroundings, a smaller proportion of window space may be allowed.

During winter, or where, as in some localities, it is a question of artificial lighting or no school at all, the respective merits of kerosene, gas, electricity, and the various forms of lamps are often discussed. I have had occasion to say, in this connection, and I repeat it here, that as a choice of evils I would prefer to have the pupil take an indefinite holiday than allow him to be immured during school hours in some of the educational dungeons that I

have known to masquerade as recitation and study-rooms. I need not enlarge upon the physical, moral, and mental ills that come to children that are forced to study or even to sit all day in a badly ventilated, artificially lighted, interior schoolroom. Better a healthy street arab than a shortsighted, anemic, neurasthenic schoolboy.

If artificial lighting is unavoidable, the same law that governs the employment of sunlight should ever be borne in mind; *the illumination should resemble as nearly as possible diffuse sunlight; it should be sufficient to permit diamond print to be easily read in any part of the room, and it should shine upon the work to be done, and not, either directly or by reflection, into the eyes of the pupils.* After all is said and done, if the lighting, natural and artificial, of all schoolrooms realized these standards, we should have few excessively myopic and fewer nervous symptoms to treat among our child population.

Owing to recent improvements in electric lamps, to the fact that the electric light does not to any extent overheat or vitiate the atmosphere of the schoolroom, to the diminished danger of fire, and to its greater convenience, it is generally to be preferred to gas or kerosene. It is, however, capable of greater harm to the vision and much more likely to produce eye-strain unless judiciously arranged. As a rule, I prefer a sufficient number of 32 candle-power lamps placed, in ground-glass globes, near the ceiling. The dazzling, uncertain, flickering, arc-lights with their irritating violet rays should never be used for school lighting or, in my judgment, for any illuminating purposes when any close work is to be done.

That the sunlight should not shine into the eyes of the school children will require a proper arrangement of the seats, desks, and blackboards. Of course, this important detail in school-house building should receive the careful attention of the architect, but it can generally be satisfactorily arranged, it matters not what exposure the schoolroom may have.

Inasmuch as the great majority of pupils are right-handed, the rays of light from whatever source of illumination, from the left, or from the left and rear, should fall upon the desk, book,

writing pads, etc., in near work, and from the rear or obliquely upon blackboards, maps, wall diagrams, or other objects required to be looked at by pupils from distant parts of the room. If windows are upon the right side of the room, they should, as in artificial lighting, be placed as near the ceiling as possible. It must be remembered that the eyes require *sufficient*, as well as *proper*, illumination to do without strain the work of ocular fixation. As Risley points out, these supplementary windows may, in summer, be used for ventilating purposes. He also suggests that where for any reason there is not sufficient sunlight admitted to a room, a second sash may be adjusted to each window on the left, which, when dropped to an angle of thirty-five or forty degrees, will act as a reflector and throw the light from the sky upon the desks of the pupils. I have myself seen such a device employed for directing the sun's rays upon a white ceiling and then by secondary reflection upon the objects in the room below. In this way the sun's rays were sufficiently diffused to render them effective and not irritating to the eyes.

While on this subject I am, of course, distinctly opposed to such means as Luxfer prisms for school lighting, valuable as these devices undoubtedly are in illuminating basements and other dark rooms of our city buildings, particularly. All schoolrooms in which pupils are expected to use their eyes to any extent should be properly lighted, outside rooms—for many reasons besides the fact that they are necessary for the ocular well-being of the children. Indeed, in the ideal school building the rooms in which pupils spend most of their time should have a south or south-eastern exposure. Excessive sunshine could be regulated by double screens—the one semi-opaque and colored light green for bright summer days, and the other cream or light gray for the less dazzling though direct sunshine of winter. If this were done recitations and other occasional tasks could be worked out in rooms on the opposite side of the building.

*The tinting of the walls.*—Although much has been written on this subject and although the rules for successful mural coloration are easily remembered, there still exists some confusion in the minds of many educators regarding this important matter. As

before stated, if the ocular apparatus is adjusted (especially during such near work as reading, writing, drawing, etc.) for diffused sunlight, the wall tints should be chosen in view of that fact. Each schoolroom should be considered by itself. If it be situated above the ground floor, has a southern exposure, faces a wide street or other large space, and particularly if there be no tall building to shut out the sunlight, the color chosen may be a light green, dull gray, or even a deep orange relieved by a lighter ceiling tint of the same color mixture. On the other hand, the walls and especially the ceiling of a recitation or study-room with a northern exposure, especially if the window space be insufficient or the view obstructed, should be papered or painted a light buff or, better still, dull white. To assist in lighting up such a room the walls should be regarded as reflecting surfaces and ought not to be unnecessarily covered with maps, diagrams, pictures, blackboards or figured wall papers. Where it is possible, dull paints on a smooth surface are preferable for use in such a room to burlap, calcimine, or wall paper.

A wider choice may be allowed in rooms and halls with a bright southern exposure; indeed, if for this reason alone it is a pity that *all* rooms cannot have either a south, a southeast, or an eastern outlook; it would permit of almost unlimited color schemes and mural decorations. Between the brightest southern exposure and the most obstructed northern view, we may then say that the mural colors should be chosen to suit the individual case. As you are aware, there are several photometric schemes devised to reduce color schemes in schoolrooms to a scientific certainty, but practically all that one needs to remember is comprised in the foregoing considerations.

*Reading matter.*—The size of the letters, the style of the type, the width of the printed columns, the spacing of the words and lines, the color and texture of the paper used in the make-up of schoolbooks are all important factors in the prevention of eye-strain and ought to receive more attention than they generally do. Without entering too deeply into these subjects I believe that the rules laid down by Cohn ought to be followed. He advises that the weight of letters like *n* be not less than 1.5 mm. and the down

strokes be at least one-fourth of a millimeter thick and, that the vertical distance between the lines be not less than 2.5 mm.

Inasmuch as the strain upon the eye muscles, both internal and external, is in direct proportion to the length of the lines, he suggests that the columns of reading matter never exceed 10 cm. Furthermore, as ocular fatigue is, other things being equal, more easily brought about in younger children than in those more advanced in years, these measurements should be increased for those of tender years. Edward Shaw proposes that for the first year in school the type should be 2.60 mm. high and the leading 4.5 mm.; for the second and third years the height ought to be at least 2 mm. with leading of 4 mm. For the fourth and subsequent years 1.8 and 3.6 mm., respectively. Considering the unavoidable variation in school lighting, I do not consider these figures unwarrantable.

A good deal of discussion and much difference of opinion is held as to the proper texture and color of paper in schoolbooks, but I do not think we shall be far wrong if we insist on a dull white paper printed with jet black ink. Likewise the copybooks, pads of paper used in school exercises, in the practice of handwriting and as substitute for greasy, dirty slates (now happily things of the past) should be a "dead" white, the ink deep black and the lead pencils as black as they can be had. Where illustrations requiring a highly calendered or shiny surface are required, these should be in the form of "tips" or inserts; the fewer of them the better. I may say in passing that the fewer magazines printed on glossy paper the child is allowed to read the better for his eyes.

*Handwriting.*—As to the relative merits of perpendicular, intermediate slanting penmanship and the decidedly slanting forms of penmanship as well as the postures assumed in each, I have little to say. In choosing one or other, let us not forget that easy legibility is desirable both for the writer and for the reader, and that it is important that the pen strokes should be thick enough to be read without eye-strain. When properly arranged desks are used and the illumination is good, perpendicular penmanship (taught in the upright position) certainly presents ocular advantages over every other form of handwriting with which I



am acquainted. Writers on this subject frequently speak of curvature of the spine as the chief danger to the child when he assumes the abnormal positions so long associated with the old Spencerian copybook. It is time to remind them once more that myopia, chronic headache, and other forms of eye-tire are much more frequent, if not more important, consequences. The strain upon ocular muscles in their efforts to make two eyes functionate for hours at unequal distances from the near point often produces those varied, complex and disastrous results that we are in the habit of speaking of as "eye-strain."

In all forms of writing and reading the book or paper should not be allowed to approach the pupil's eyes nearer than 35 cm. If he persists, with normal surroundings, in reading or writing at a nearer point, one may suspect an approaching myopia, or that he has a refractive (farsighted, a stigmatic, etc.), or accommodative error that demands attention.

A few words about *blackboards and maps*. The objections to many of the former are manifold. As long as they are dull finished and kept clean of chalk dust, they do not reflect the light into the eyes of the pupils. They are not objectionable except that they may interfere with the proper lighting of the room. All blackboards should be frequently cleaned with competent erasers and the writing upon them should always be large and heavy and be done with soft, white crayons. When colored chalks are used one must recollect that yellow and blue are the colors most easily recognized by pupils with defective vision and defective color-sense. Wall maps of all sorts ought to have a restricted use in the schoolroom, owing to the extreme difficulty with which a mass of names (some of them in small print) are made out by pupils some distance away.

*Size of the schoolroom.*—Apart from the question of air, space, ventilation, and lighting, the size of the schoolroom is very important from the visual standpoint. When pupils are seated at desks too far removed from blackboards, maps, specimens on exhibition, etc., they are likely to suffer from eye-strain, particularly if they have weak eye muscles or are slightly shortsighted. In these events the ocular apparatus makes an abnormal effort to

overcome the defect and reflex symptoms result. Probably  $25 \times 30$  feet are the maximum ground measurements. Such a room, with proper ceilings, window space, etc., will accommodate from 45 to 50 pupils.

*Detection of disease.*—I have already referred to the desirability of having school-children's eyes examined at the beginning of the scholastic year. Let me say briefly, in this connection, that the scheme first proposed by Dr. Risley and subsequently elaborated by my associate in medical practice, Dr. Frank Allport, provides that at least one teacher in each school be instructed in this work, that it can easily be carried out in practice, and it has been recommended by many Boards of Health and adopted by a number of School Boards.

In a few of the states these methods have also been adopted by the legislature, and in my opinion they ought to be further employed as the most practical and most useful means of detecting diseased eyes and ears that I know of. The examining teacher does not pretend to diagnose the case in hand; he or she merely applies certain tests and makes sundry observations that any layman may, to determine whether or not the services of a physician are desirable—whether further medical examination is indicated or not.

*The school desk.*—I am well aware that I am walking in slippery places when I approach the desk question, but it has a very important bearing on eyesight. As a proof that I am not commercially interested in any particular desk, I will say that there are, in my judgment, several good forms of that kind of school furniture on the market, the names of whose makers I shall refrain from mentioning.

First of all, I am in favor of *single*, adjustable desks with a sliding top, as better suited to the *minus* and *plus* distance required for the comfort and accommodation of the growing individual child. The desk should be adjusted vertically at the beginning and in the middle of each school year. It should be without foot rests; the lid should have a slope of 10 to 15 degrees as best fitted to the perpendicular or slightly slanting chirography. When, for certain kinds of work, it is necessary that the desk be almost flat,

a couple of small supports from the interior of the box desk may easily be arranged to accomplish this end.

*Length of time consumed in schoolroom study and recitation.*—So far as ocular strain is concerned, surely experience will teach the observing educator that when the attention is for too long a period fixed upon a book, blackboard, writing pad, map, or other object, or if the class is too long bombarded with questions regarding the same, all kinds of fatigue, mental and physical, result. So is it with the oculo-nervous apparatus. It is of course difficult to lay down a rule applicable to every child. Edward Shaw believes, and I am sure most oculists will agree with him, that recitations should not for the first year exceed 10 minutes in length, for the second year 15 minutes, and so on, gradually increasing the study period until the highest grade is reached with a maximum of 45 minutes. Similarly, study hours in school should be frequently interrupted in the interest of eyesight and the nervous system.

*Study out of school.*—If I had my way, I would not allow any child to do reading (especially of newspapers and magazines) or studying out of school hours until he or she were at least ten years of age. "Oh! how will they pass their time at home?" and then adds the anxious mother with a sigh: "There is so much for them to read!" My answer would be: "Read to them yourself or have somebody else do it, or, better still, give them some constructive manual work to do in their playroom during the winter evenings, and turn them out into the air when the days are propitious." Especially for our precocious, over-stimulated, native-born American children exercise in fresh air, sound sleep, and healthful, interesting exercise are more desirable than rubies and—at least as far as the eyes are concerned—are in the end a better commercial investment.

In closing this incomplete study of the schoolroom and its influences upon eyesight for good and evil, let me draw your attention to the fact that almost without exception the laws of ocular sanitation are in accord with other rules of personal hygiene, thus furnishing evidence of the dimly recognized truism that ophthalmology is not an art or a science apart, but is merely one chapter of the whole philosophy of healing.